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## Description

The invention relates to a body panel for a vehicle, comprising a sheet formed of one or more layers and a structural member connected to said sheet to support it and provide for mounting of the sheet to the vehicle. The sheet is intended for application as an exterior part of the vehicle.

Such a body panel, for example a bonnet (hood) or a boot (trunk) lid (see also JP-A-57178925), is known from the practice in the automotive art. This conventional body panel usually consists of a more or less flat sheet which has been given a certain curvature corresponding with the desired appearance of the vehicle in question, and a press-moulded structural member is attached to the inside of the sheet to reinforce the sheet against bending, and by which the sheet is connected to the vehicle. The disadvantage of this known body panel is that it is rather heavy, which is caused in particular by the robust construction of the supporting structural member.

Various attempts have been made to retain strength and rigidity in the body panel while reducing weight. US-A-2709108 is an early attempt to overcome the problem and describes a "Y"-shaped or wishbone reinforcement, in which the two legs of the "Y" reinforce the flat sheet in the region of attachment to the vehicle. DE-A-2934430 describes a hollow strengthening part that is directly bound to a panel. DE-A-1627719 describes the attachment of strengthening members to boots, doors etc. using curable plastics, for example based on PVC. JP-A-57-178925 proposes that a straight reinforcing beam of uniform profile along its length is adhesively secured to the inner face of the panel sheet, to avoid welding marks.

The object of the invention is to provide a comparatively light, yet strong, body panel which is easy to manufacture.

The body panel in accordance with the invention in one aspect is characterised in that the supporting structural member consists of an elongate element which lies against the sheet and follows the curvature of the sheet and which comprises at least one bend. It has been found that a body panel manufactured in this manner can have the required rigidity lengthwise and widthwise, yet can be constructed much lighter than the conventional body panel described above, due to less material consumption. In particular, the combination of a bent structural member and adhesive face-to-face securing of it to the sheet, provides a light yet rigid structure. In addition the material to be used for the supporting structural member can be of an inferior quality, as its deep drawing properties are less critical than with the press-formed supporting structural member of the conventional panel.

A further significant advantage is that hardly any material is wasted in manufacturing the structural member used in the invention, which enables an inexpensive production. The reason why less material is wasted is that the member to be used can be cut to the required length beforehand, after which only deformation into the desired shape simply needs to take place. The member and the sheet can be joined using known connecting techniques, such as for example by glueing or riveting.

The invention is well applicable to sheets made of steel but also a particularly good application is possible to sheets made of aluminium or to a laminate having skin layers of aluminium or steel and a thermoplastic core.

In another aspect, the invention consists in a body panel having a sheet and connected thereto an elongate supporting structural member having at least two bends.

In particular, an even more robust construction of the body panel in accordance with the invention is achieved by providing the member along its length with three bends and four portions of lesser curvature (e.g. straight), the bends and the portions alternating, with the extremities of the member formed by two of the portions. The middle bend is in the opposite direction to that of the other two. This gives the member a "Cupid's bow" shape. In this manner the entire area of the sheet to be supported can be subdivided into three about equally large areas. Using the supporting member which thus follows the curved surface of the sheet, a very effective support and resistance to bending is achieved in the sheet surface.

Preferably the two extremities of the member support the sheet at or near a side edge which is intended for mounting to the vehicle. In this manner the supporting function of the member is best combined with the function of mounting the body panel to the vehicle. Furthermore, the middle bend of the member preferably also supports the sheet adjacent that side edge which is intended for mounting to the vehicle. Then the division into areas mentioned earlier can produce optimum effects for the ability of the integral body panel to retain its shape.

Preferably the structural member is made using substantially the same material, or the same type of material, as at least the layer of the sheet against which it directly abuts. In this manner differences in the thermal expansion of the sheet and the supporting member are prevented as much as possible and in addition, susceptibility to contact corrosion is avoided.

In a preferred embodiment of the body panel in accordance with the invention, the panel is entirely made of aluminium (by which term, we include aluminium alloys). In this manner a very light and

manageable construction is provided, which has the added benefit that the structural member in aluminium can be manufactured in a very simple and inexpensive manner by extrusion followed by a bending operation. The profile of the element may be flat, which allows good attachment to the body panel.

Typically, the sheet has curvature in at least one plane, often in two planes, and the structural member lying against the sheet follows this curvature.

The invention will now be illustrated further with reference to the accompanying drawing, which shows a non-limitative embodiment, by way of example. In the drawing:-

Figure 1 shows an under view of a body panel in accordance with the invention.

Figure 1 is an underneath plan view of a body panel embodying the invention, consisting of an aluminium sheet 2, whose underface 1 is seen, and a reinforcing structural member 3. The sheet 2 has, in conventional manner, double curvature, i.e. curvature in two planes, though this is not visible in the Figure. When fitted to a vehicle the panel is pivotable about a line adjacent to its lower side edge in Figure 1.

The structural member 3 is an elongate extrusion of aluminium of flat cross-section which is uniform along its length. This profile is hollow to save weight and material, and may be provided with reinforcing ribs (not shown). One of its flat faces is adhesively bonded continuously to the underface 1 of the sheet 2 over the whole length of the member 3. The height of the member 3 in the direction perpendicular to the paper in Figure 1 is less than its width.

The member 3 has extremities 4 and 5 and can be seen to consist of four more or less straight parts 6,7,8 and 9 which alternate with three bends 10,11 and 12. The middle bend 12 is in the opposite direction relative to the outer bends 10,12. This gives the member a "Cupid's bow" shape, as seen in Figure 1.

The member 3 follows the curvature of the underside 1 of the body panel sheet 2 over its entire length, and it is fixed to the sheet 2, for example by glueing, as mentioned. Suitable glues are known. The shape of the member 3 defines areas A, B, C which are preferably chosen to be approximately equal in size. Both extremities 4 and 5 are suitable to be used as fastening points for connecting the body panel 1 to the vehicle for which it is intended. This may be done by bolting triangular flanges (not shown) to the member 3 at the extremities 4,5.

In this embodiment both the underside 1 of the sheet 2 and the member 3 are made of the same material, aluminium. This provides a particularly

light and manageable construction, which is yet resistant to bending and which can nevertheless be manufactured at low cost. With this invention a saving in weight by approximately twenty per cent as compared to the conventional panel mentioned above has been found possible. A steel body panel manufactured by the conventional technique weighs approximately ten kilograms, whereas a similar body panel in accordance with the invention as illustrated weighs approximately eight kilograms, and a body panel in accordance with the invention in which the sheet is formed by a laminate with aluminium skin layers and a plastics core layer and the supporting member 3 is also made of aluminium may weigh approximately four kilograms.

### Claims

1. Body panel for a vehicle intended for use as an exterior part of the vehicle, comprising a sheet (2) formed of one or more layers, and an elongate supporting structural member (3) of uniform cross-sectional shape along its length connected to the sheet (2) for support of the sheet and mounting of the sheet to the vehicle, the structural member (3) lying against the sheet (2) so as to follow the shape of the sheet, characterized in that as seen looking at a face of the sheet (2) the structural member has at least one bend (10,11,12) and portions extending away from said bend.
2. Body panel in accordance with claim 1, wherein the structural member (3) has three said bends (10,11,12) and four portions (6,7,8,9) of lesser curvature than said bends, said three bends and said four portions alternating along the structural member, the middle one (11) of said bends being in the opposite direction relative to the outer two bends (10,12) and the two extremities of the structural member being formed by two of the four said portions.
3. Body panel in accordance with claim 1 or claim 2, wherein both extremities (4,5) of the structural member (3) support the sheet adjacent one side edge of the sheet at regions intended for mounting to the vehicle.
4. Body panel in accordance with any one of claims 1 to 3 wherein at least one said bend of said structural member (3) supports the sheet adjacent one side edge of the sheet, which side edge is intended for mounting to the vehicle.

5. Body panel in accordance with any one of the preceding claims wherein the structural member (3) is made of the same type of material as a layer of said sheet against which it directly abuts.
6. Body panel in accordance with any one of claims 1 to 5 wherein the structural member (3) is made of aluminium.
7. Body panel in accordance with claim 6, wherein the structural member (3) is an aluminium extrusion.
8. Body panel in accordance with any one of the preceding claims wherein said structural member (3) has a face which is secured by adhesive to said sheet (2) along the whole length of the structural member (3).
9. Body panel in accordance with any one of the preceding claims wherein said sheet (2) has curvature in at least one plane, and said structural member (3) follows said curvature.
10. Body panel for a vehicle intended for use as an exterior part of the vehicle comprising a sheet (2) comprising at least one layer, and an elongate supporting structural member (3) connected to the sheet for support of the sheet and mounting of the sheet to the vehicle, the supporting structural member (3) following the shape of the sheet (2) characterized in that as seen looking at a face of the sheet, the structural member (3) has along its length at least two bends (10,11,12) of opposite directions.
11. Body panel in accordance with claim 10, wherein the structural member (3) has along its length three said bends (10,11,12) and four other portions (6,7,8,9) of lesser curvature than said bends, the bends and the other portions alternating along the sheet and both extremities (4,5) of the structural member being provided by said other portions.
12. Body panel in accordance with claim 10 or claim 11 wherein said structural member (3) is an extrusion having a uniform cross sectional shape along its whole length.

#### Patentansprüche

1. Plattenkörper für ein Fahrzeug, bestimmt für die Verwendung als ein äußerer Teil des Fahrzeugs, der ein Blech (2), das aus einer oder mehreren Schichten gebildet ist, und ein langgestrecktes tragendes Strukturglied (3) gleich-

förmiger Querschnittsform über seine Länge aufweist, welches mit dem Blech (2) zum Tragen des Blechs und zur Befestigung des Blechs an dem Fahrzeug verbunden ist, wobei das Strukturglied (3) derart gegen das Blech (2) anliegt, damit es der Formgebung des Blechs folgt, dadurch gekennzeichnet, daß in der Ansicht auf eine Seite des Blechs (2) das Strukturglied zumindest einen Bogen (10, 11, 12) und Abschnitte aufweist, die sich von besagtem Bogen weg erstrecken.

2. Plattenkörper entsprechend Anspruch 1, bei dem das Strukturglied (3) drei besagte Bögen (10, 11, 12) und vier Abschnitte (6, 7, 8, 9) geringerer Biegung als besagte Bögen hat, wobei besagte Bögen und besagte vier Abschnitte sich entlang des Strukturglieds abwechseln, der mittlere (11) von besagten Bögen in entgegengesetzter Richtung in Bezug zu den äußeren beiden Bögen (10, 11) ist und die beiden Enden des Strukturglieds durch zwei der vier besagten Abschnitte gebildet wird.
3. Plattenkörper entsprechend Anspruch 1 oder Anspruch 2, bei dem beide Enden (4, 5) des Strukturglieds (3) das Blech benachbart einer Seitenkante des Blechs in Bereichen tragen, die für die Befestigung am Fahrzeug bestimmt ist.
4. Plattenkörper entsprechend einem der Ansprüche 1 bis 3, bei dem zumindest ein besagter Bogen des besagten Strukturglieds (3) das Blech benachbart einer Seitenkante des Blechs trägt, welche Seitenkante für die Befestigung an dem Fahrzeug bestimmt ist.
5. Plattenkörper entsprechend einem der vorhergehenden Ansprüche, bei dem das Strukturglied aus derselben Art Material hergestellt ist wie eine Schicht des besagten Blechs, gegen das es direkt anliegt.
6. Plattenkörper entsprechend einem der Ansprüche 1 bis 5, bei dem das Strukturglied (3) aus Aluminium hergestellt ist.
7. Plattenkörper entsprechend Anspruch 6, bei dem das Strukturglied (3) aus Aluminium extrudiert ist.
8. Plattenkörper entsprechend einem der vorhergehenden Ansprüche, bei dem besagtes Strukturglied eine Seite hat, die durch einen Klebstoff an besagtem Blech (2) über die gesamte

Länge des Strukturglieds (3) befestigt ist.

9. Plattenkörper entsprechend einem der vorhergehenden Ansprüche, bei dem besagtes Blech (2) eine Biegung in zumindest einer Ebene hat und besagtes Strukturglied (3) besagter Biegung folgt. 5
10. Plattenkörper für ein Fahrzeug, bestimmt für die Verwendung als ein äußeres Teil des Fahrzeugs, der ein Blech (2), das zumindest eine Schicht aufweist, und ein langgestrecktes, tragendes Strukturglied (3) aufweist, das mit dem Blech zum Tragen des Blechs und zur Befestigung des Blechs an dem Fahrzeug verbunden ist, wobei das tragende Strukturglied der Formgebung des Blechs (2) folgt, dadurch gekennzeichnet, daß in der Ansicht auf eine Seite des Blechs das Strukturglied (3) über seine Länge zumindest zwei Bögen (10, 11, 12) von entgegengesetzten Richtungen hat. 10 15 20
11. Plattenkörper entsprechend Anspruch 10, bei dem das Strukturglied (3) über seine Länge drei besagte Bögen (10, 11, 12) und vier weitere Abschnitte (6, 7, 8, 9) von geringerer Biegung als besagte Bögen hat, wobei die Bögen und die weiteren Abschnitte sich entlang des Blechs abwechseln und beide Enden (4, 5) des Strukturglieds mit besagten weiteren Abschnitten versehen sind. 25 30
12. Plattenkörper nach Anspruch 10 oder 11, bei dem besagtes Strukturglied extrudiert ist und eine gleichbleibende Querschnittsform entlang seiner gesamten Länge hat. 35

#### Revendications

1. Panneau de carrosserie pour un véhicule, conçu pour être utilisé comme partie extérieure du véhicule, comportant une feuille (2) formée d'une ou de plusieurs couches, et un élément structural de support allongé (3) ayant une forme de section transversale uniforme le long de sa longueur, connecté à la feuille (2) pour supporter la feuille et pour monter la feuille sur le véhicule, l'élément structural (3) reposant contre la feuille (2) de façon à suivre la forme de la feuille, caractérisé en ce que, vu en regardant une face de la feuille (2), l'élément structural comporte au moins une courbure (10, 11, 12) et des parties s'éloignant de ladite courbure. 40 45 50
2. Panneau de carrosserie selon la revendication 1, dans lequel l'élément structural (3) comporte trois desdites courbures (10, 11, 12) et quatre 55

parties (6, 7, 8, 9) ayant une courbure inférieure à celle desdites courbures, lesdites trois courbures et lesdites quatre parties alternant le long de l'élément structural, la courbure médiane (11) desdites courbures étant dans la direction opposée à celle des deux courbures extérieures (10, 12) et les deux extrémités de l'élément structural étant formées par deux desdites quatre parties.

3. Panneau de carrosserie selon la revendication 1 ou la revendication 2, dans lequel les deux extrémités (4, 5) de l'élément structural (3) supportent la feuille au voisinage d'un bord latéral de la feuille au niveau de régions prévues pour le montage sur le véhicule.
4. Panneau de carrosserie selon l'une quelconque des revendications 1 à 3, dans lequel au moins l'une des courbures dudit élément structural (3) supporte la feuille au voisinage d'un bord latéral de la feuille, ce bord latéral étant prévu pour le montage sur le véhicule.
5. Panneau de carrosserie selon l'une quelconque des revendications précédentes, dans lequel l'élément structural (3) est fait du même type de matériau qu'une couche de ladite feuille contre laquelle il bute directement.
6. Panneau de carrosserie selon l'une quelconque des revendications 1 à 5, dans lequel l'élément structural (3) est fait en aluminium.
7. Panneau de carrosserie selon la revendication 6, dans lequel l'élément structural (3) est une extrusion d'aluminium.
8. Panneau de carrosserie selon l'une quelconque des revendications précédentes, dans lequel ledit élément structural (3) comporte une face qui est fixée par un adhésif à ladite feuille (2) le long de toute la longueur de l'élément structural (3).
9. Panneau de carrosserie selon l'une quelconque des revendications précédentes, dans lequel ladite feuille (2) comporte une courbure dans au moins un plan, et ledit élément structural (3) suit ladite courbure.
10. Panneau de carrosserie pour un véhicule, conçu pour être utilisé comme pièce extérieure du véhicule, comportant une feuille (2) comprenant au moins une couche, et un élément structural de support allongé (3) connecté à la feuille pour supporter la feuille et pour monter la feuille sur le véhicule, l'élément structural de

support (3) suivant la forme de la feuille (2), caractérisé en ce que, vu en regardant une face de la feuille, l'élément structurel (3) comporte le long de sa longueur au moins deux courbures (10, 11, 12) suivant des directions opposées.

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11. Panneau de carrosserie selon la revendication 10, dans lequel l'élément structurel (3) comporte, le long de sa longueur, trois desdites courbures (10, 11, 12) et quatre autres parties (6, 7, 8, 9) ayant une courbure inférieure auxdites courbures, les courbures et les autres parties alternant le long de la feuille, et les deux extrémités (4, 5) de l'élément structurel étant constituées par lesdites autres parties.

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12. Panneau de carrosserie selon la revendication 10 ou la revendication 11, dans lequel ledit élément structurel (3) est une extrusion ayant une forme de section transversale uniforme le long de la totalité de sa longueur.

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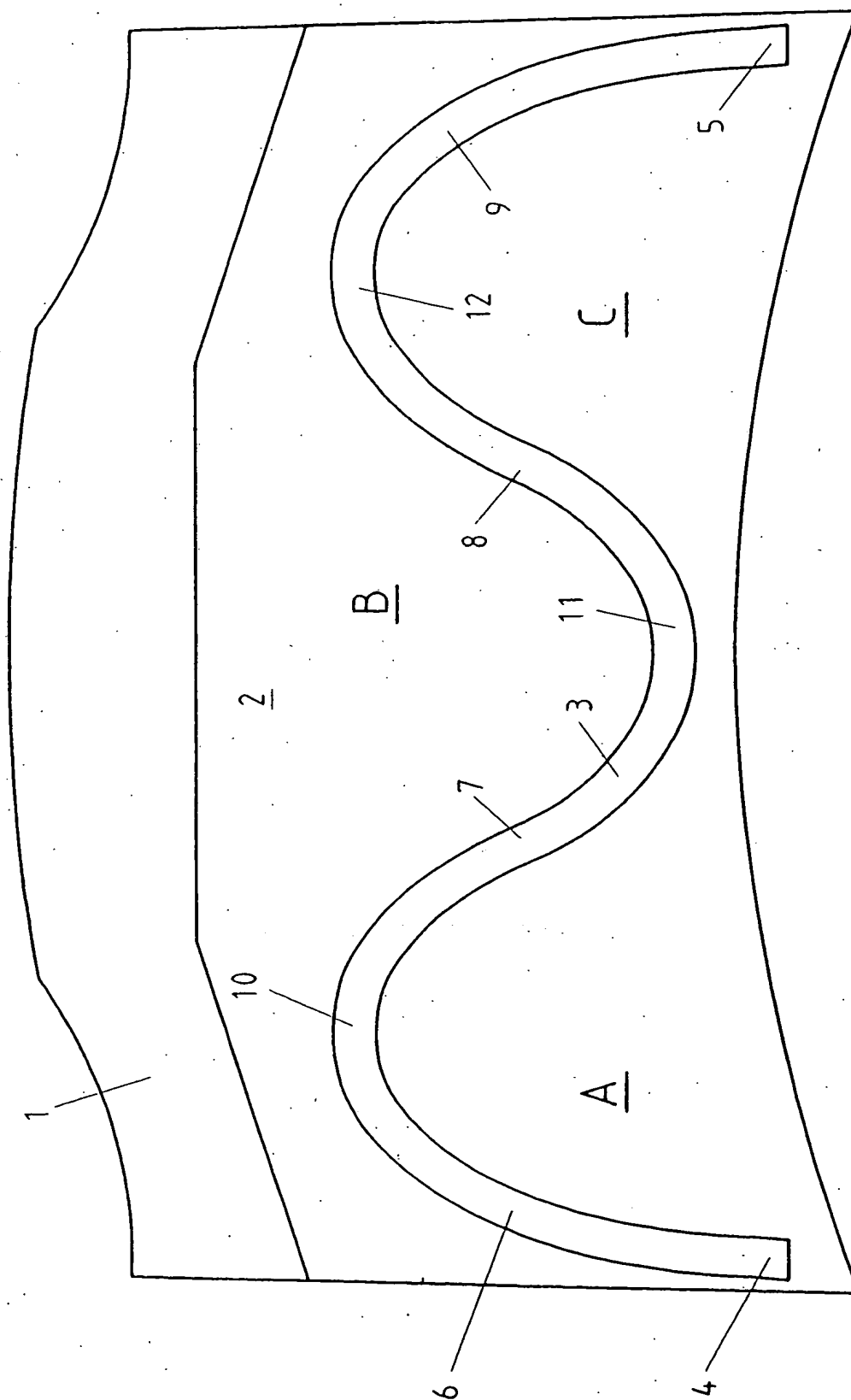


FIG. 1

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